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AUTHOR Tyler, Andrea; Nagy, William E.
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ABSTRACT

Knowledge of derivational morphology can aid readers in the analysis and acquisition of new vocabulary, in lexical access, and in establishing the syntactic structure of sentences. A study investigated good and poor readers' knowledge and use of derivational suffixes in establishing sentence level syntax. Subjects, 123 10th and 11th grade students, completed a vocabulary checklist test, a comprehension test, and a direct test of morphological knowledge. Results indicated that knowledge and use of derivational morphology was correlated with reading ability. However, for both good and poor readers, the use of knowledge about morphological structure of complex forms was task specific. Although the students possessed knowledge of the syntactic properties of derivational suffixes, even the above average readers did not appear to use such knowledge in a task that required reading for meaning. (Author/FL)

CENTER FOR THE STUDY OF READING

Technical Report No. 357

THE ROLE OF DERIVATIONAL SUFFIXES IN SENTENCE COMPREHENSION

Andrea Tyler

William E. Nagy

University of Illinois at Urbana-Champaign

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University of Illinois
at Urbana-Champaign
51 Gerty Drive
Champaign, Illinois 61820

Bolt Beranek and Newman Inc.
10 Moulton Street
Cambridge, Massachusetts 02238

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Abstract

Knowledge of derivational morphology potentially aids readers in the analysis and acquisition of new vocabulary, in lexical access and in establishing the syntactic structure of sentences. Although a number of studies have investigated the role of derivational morphology in acquiring vocabulary and in the organization of the internal lexicon, none have investigated the syntactic role of derivational morphology in sentence processing. In this work, we report on a study which investigated good and poor high school students' knowledge and use of derivational suffixes in establishing sentence level syntax. The results indicate that knowledge and use of derivational morphology is correlated with reading ability. However, for all readers the use of morphological structure of complex forms is task specific; although high school students possess knowledge of the syntactic properties of derivational suffixes, even above average readers do not appear to utilize such knowledge in a task which requires reading for meaning.

The Role in Derivational Suffices in Sentence Comprehension

Several studies have investigated how morphologically complex words are stored in memory (Taft, 1979; Stanners, Neisser, Hernon, & Hall, 1979; Kempley & Morton, 1982; Bradley, 1979) and a few have looked at the extent to which knowledge of suffixes is used in learning new words (Condry, 1980; Freyd & Baron, 1982; Wysocki & Jenkins, 1985). However, no studies of derivational morphology have investigated how the syntactic information provided by derivational suffixes, i.e. those that change part of speech, might be used during sentence processing. In this paper, we report on a study which investigates good and poor high school readers' use of derivational suffixes in establishing sentence level syntax.

The Role of Derivational Morphology in Written English

Over the past 20 years, researchers have noted structural differences between the language used in written and spoken English (Drieman, 1962; Devito, 1966; Harrell, 1957; Kroll, 1977; O'Donnell, 1974). Most recently, Chafe (1980, 1983) compared the language used by 25 adults in their informal dinner conversations, personal letters, academic lectures, and academic writing. He reported that the information load is generally greater in a written English sentence than in a spoken English sentence. Information is packed into written English through

variety of complex structures which occur infrequently in spoken English.

Chafe's studies indicate that derivationally complex words occur more often in written English than in spoken English. In fact, Chafe states that the most characteristic "integrative," i.e., information packing, device in written language is nominalization. According to Chafe's data, nominalizations occur almost twelve times as often in written English as in spoken English. Moreover, he found a great absolute increase in the number of attributive adjectives in written English. Chafe summarizes, "While nominalizations show the greatest proportional difference across the two kinds of language (spoken and written), attributive adjectives are the single most prevalent feature of written language" (1980, p. 42). Since nominalizations and adjectives tend to be formed with derivational suffixes, such suffixes are clearly more important in written English than in spoken English

In spoken language, information is carried by a rich array of cues many of which are absent in written English. In a face-to-face conversation the speaker bolsters the linguistic message with non-lingustic cues such as facial expression, posture, hand gestures, or shoulder shrugs. Syntactic information about constituent structure is provided in spoken English by prosody cues (Fodor, Bever, & Garrett, 1974). In the reading situation, readers face language which contains structures different and

often more complex than those they encounters in conversation; and at the same time they lose access to prosodic and physical cues useful in establishing both syntax and semantics. Little is known about how readers cope with the absence of oral cues in conjunction with increasing structural complexity. One possibility is that successful readers learn to utilize signals in the written message which are either absent or relatively unimportant in spoken language. One factor contributing to reading difficulty might be the failure to pay attention to cues which are more typically provided in written English than in spoken English.

Derivational morphology is one such linguistic structure. Because derivational suffixes overtly mark words for part of speech, they potentially provide additional syntactic clues which might be helpful in sentence processing. Attending to the syntactic clues associated with suffixes could help compensate for the absense of prosody and other oral cues in written English; failure to attend to suffixes could interfere with the reader establishing correct syntactic structures. In reading, then, suffixes which overtly code syntax could potentially take on more importance in establishing syntactic structure than in spoken English.

While suffixes appear to be potentially important, helpful markers of syntactic structure for the reader, it is far from evident that high school students, particularly poorer readers,

are able to exploit them. Recent research, in fact, suggests that many readers are not. Shaughnessey (1977) reported that many of the underprepared college writers she encountered misused derivational suffixes when they tried to use syntax more complicated than that of normal conversation, as in "She tells the difference changes that the woman have experienced" and "It is protecting familyhood of which I am a strong belief" (p. 75). The interaction between complex syntax and derivational morphology appears to cause trouble for lower ability writers, who are also generally lower ability readers. If these students lack knowledge of the syntactic features associated with the suffixes, they would not be able to exploit the overt coding for syntax provided by the suffixes during reading. Thus they would miss certain cues to sentence syntax provided by the language. One factor contributing to their reading difficulty might be incomplete knowledge of derivational suffixes. But how likely is it that college-age speakers have not mastered derivational morphology?

Difficulties in the Acquisition of English Derivational Suffixes

There are a number of reasons to expect that English derivational suffixes would be acquired relatively late, and would show large individual differences. First of all, unlike rules of syntax, rules of derivational morphology are not central to establishing communicative competence in English. As far as syntax is concerned, most of the sentences a person utters are

novel; the speaker of the sentence has not previously heard or said that particular sentence. With individual words, on the other hand, such creativity is the exception rather than the rule; almost all of the words a person utters are words which that person has heard or used before.

Since the number of morphologically complex words (excluding compound nouns) a speaker encounters is limited, it is possible to learn them individually without taking their internal morphological structure into account. Work in child language acquisition (Berko-Gleason, 1971; Bowerman, 1982; Peters, 1983) shows that children do initially acquire complex words as unanalyzed wholes. Although many speakers go on to analyze words and see the relationships between word families, this is not necessary in order to use a particular word. In fact, many potentially analyzable words probably remain unanalyzed for most adult speakers. For instance, we suspect that many adults are not conscious of the relationships between pairs of words such as script/scribble, drip/dribble, heal/health, carry/carriage, apart/apartment, or base/basement. Gleitman and Gleitman (1979) suggest that, to some extent, knowledge of the morphological structure of complex words may be a linguistic luxury, acquired by only some speakers. Thus, some readers might only rarely analyze complex forms and never consistently associate syntactic features with particular suffixes.

Various irregularities in English derivational morphology pose another type of hindrance to their acquisition. The semantic irregularities that arise as word meanings change over time are numerous. Chomsky (1970), Jackendoff (1975), Aronoff (1976) and many others have pointed out semantic irregularities among derived nominals and their verbs. For example, the relationships between revolve and revolution, posit and position, and inscribe and inscription are all quite different.

Apart from such idiosyncracies of lexical semantics, the whole system of English derivational suffixes has several properties which make it difficult to learn. In a series of cross-lingusitic studies, Slobin (1973) found that if a marker is ambiguous, it is more difficult for children to learn. And if a syntactic relationship has more than one surface marker, it is more difficult to learn. The children he studied found it easier to acquire grammatical markers which represent clear, one-to-one syntactic and semantic relationships. English derivational suffixes do not follow this pattern.

For example, English contains many suffixes which have the same function. There is not merely one marker for abstract nouns; instead English contains many abstract noun markers: -ity, -ness, -tion, -tude, -hood, -ship, -age, etc. No uniform, unique marker for this particular syntactic/semantic relationship exists in English. This is the case with nearly all English

suffixes, e.g., agentival suffixes: -er, -ist, -ian, -eer and adjective: -ive, -ic, -al, -ent, -ous.

Even worse for the language learner, a number of derivational suffixes are ambiguous in terms of their syntactic and semantic properties. For instance, -ate is commonly a verb ending as in hesitate and dominate as well as an adjective ending as in fortunate or considerate and a noun ending as in delegate. Even -ly can have two syntactic roles, showing up as an adjectival suffix in words such as friendly and lively instead of maintaining its more common adverbial role.

In sum, much in English derivational morphology is complex and opaque, and thus difficult to learn. To a large degree, this is due to the fact that derivational suffixes in English do not have one-to-one semantic and syntactic relationships. This suggests that speakers will acquire derivational morphology relatively late and that they may vary widely in their mastery and use of morphology, particularly in their use of suffixal information which is most variable. This conclusion finds some support in the experimental literature but the results are mixed and somewhat unclear.

Experimental Findings on the Acquisition of Derivational Suffixes

Children seem to be in the process of acquiring knowledge about English morphology throughout their school years, and into college. There is unequivocal, although anecdotal, evidence that preschoolers sometimes productively use suffixes such as -ness or

agentive -er. Derwing and Baker (1977) found increased use of derivational suffixes in subjects ranging from elementary school age through adults. Condry (1980) found that children in grades 2, 4 and 6 had some knowledge of frequent suffixes such as -er, -ness, -ly and -able. Wysocki and Jenkins (1985) found that students in 4th, 6th, and 8th grades showed increasing ability to use knowledge of stems (e.g., melancholy) to learn the meanings of suffixed forms (e.g., melancholia). Kaye and Sternberg (1982) found that college students, but not high school and junior high students, were able to utilize the meanings of Latin roots and affixes to correctly answer multiple-choice questions about the meanings of low-frequency words such as exsect.

Ability Differences in Knowledge of Derivational Suffixes

Freyd and Baron (1982) studied differences in the acquisition of derivational suffixes between average 8th graders and above average 5th graders. These groups were chosen in an attempt to control for overall vocabulary knowledge. Subjects were asked to learn nonce words half of which were related by consistent derivational suffixes used in English. For example, one nonce form was flur "tc play" and its derived form was flurment "game." The other half of the pairs were not related morphologically. The subjects were tested over their ability to correctly define the nonce words. The results showed that the 5th graders learned all the nonsense words better than the 8th graders but that they were significantly more successful on the

morphologically related pairs. The 8th graders showed no substantial difference in ability to learn unrelated word pairs as opposed to related word pairs. When asked about any tricks they had for learning words, 5th graders often mentioned paying attention to the endings of words. Subjects in 8th grade did not mention this and instead offered sequential ordering hints. Freyd and Baron reported that a number of the 8th graders seemed totally unaware of any semantic relation between the related nonsense stimuli. Freyd and Baron concluded that average 8th graders appeared not to use derivational relations in learning vocabulary while excelled 5th graders did.

Knowledge of the Syntactic Properties of Derivational Suffixes

Although Freyd and Baron found substantial differences between the two groups in their use of morphological relations to learn new words, they reported that both groups had difficulty correctly paraphrasing the information contained in the suffix. In many cases the affix was ignored in terms of its semantic and syntactic contributions. When the subjects defined a word, they often gave simply the core semantic meaning of the root. Even the excelled group who appeared to be able to analyze words into parts often failed to correctly explain the contribution of the suffix.

This seems rather surprising. Since the suffixes were commonly occurring ones, all the subjects had been exposed to them many, many times. One might except that repeated exposure

would be sufficient to acquaint the subjects with these suffixes. Moreover, since the role of derivational suffixes is to mark change in part-of-speech categories, one would expect the syntactic properties of the suffixes to be a salient aspect of a suffixed word. More generally, it seems that the part of speech is one of the first things learned about a word (Carey, 1978).

However, it is not clear that the definition task which Freyd and Baron asked the students to preform reflected the subjects' true knowledge of morphology. The result might very well be showing the subjects adeptness at creating definitions as much as their knowledge of the syntactic properties of suffixes. One must be fairly sophisticated in terms of metalinguistic insight and dictionary-ese to be able to articulate that -ment means "the state of being _____" or -ize means "the act of _____ing."

Wysocki and Jenkins (1985) similarly found children's ability to use suffixes in learning new words to exceed their ability to describe the syntactic function of those suffixes. Wysocki and Jenkins were investigating the extent to which morphological generalization, i.e. decomposition in order to derive the meaning of unknown words, can account for increases in vocabulary size. Subjects were students from 4th, 6th and 8th grades. The subjects were taught six unfamiliar, low frequency, morphologically complex words in three fifteen minute sessions. Two weeks later subjects were given sentences which contained

related forms of the target words and asked to define the words. For instance, the students learned the word melancholy. In the posttest they were asked to read the sentence "Her melancholia lasted seven days" and define melancholia.

Answers were scored for correct lexical-semantic and correct syntactic features. So for the word sapience the definition "wisdom" was credited for both correct semantics and syntax, the definition "wise" was credited for correct semantics but incorrect syntax. Subjects showed modest use of semantic and syntactic morphological generalization; eighth graders generalized to 2.42 words out of six, sixth graders generalized to 1.86 words, and fourth graders to 1.17. When responses were scored only for semantic generalization the results were somewhat higher; eighth graders generalized to 3.5 words out of 6, sixth graders to 3.3 words, and fourth graders to 2.6 words.

Subjects tended to respond to the target words with definitions of the original words, giving the appearance of using the information from the semantic core more than information from the suffixes. Wysocki and Jenkins speculated that the subjects may not have noticed the difference between the original and target words or that they recognized the differences but did not know how to alter the definitions to reflect the change. They favor the former interpretation because a few younger children gave definitions such as wiseness for sapience, showing they did have knowledge of suffixes. Wysocki and Jenkins take this as

evidence that all children are capable of morphological decomposition but that the majority just failed to notice the change in suffix.

As with the Freyd and Baron study, it is important to note that the children were asked to define abstract suffixes. The task could very well underestimate the children's knowledge of morphology. The children could have been aware of the syntactic contribution made by the suffix but failed to incorporate it into their definitions.

Since Wynsocki and Jenkins did not control for reading ability or language ability, we don't know who those few more articulate subjects were. It seems just as likely that only these few knew much about derivational suffixes such as -ence, at least at 4th grade. One result which supports this interpretation is that the percentage of children at each grade level who show strong morphological generalization is quite small. Many students at each grade level showed no generalization at all and only a few--2.2% at 6th grade and 2.4% at 8th grade--generalized to five words out of six. This fact suggests the possibility that some children become aware of nontransparent morphology at a very eary age and remain aware of it, while others simply treat those forms as unanalyzable wholes. But is this the case with all derivational suffixes? Like Sternberg and Powell, Wynsocki and Jenkins tested their subjects over Latin suffixes which are phonologically and sometimes semantically and syntactically

opaque. These same students might have performed better on more familiar, transparent suffixes such as -ness or -ment.

In fact, Condry (1980) found evidence that grade school children have some knowledge of the syntactic features of -ly, -er, and -ness, but her results are mixed. She tested 2nd, 4th, and 6th graders on -er, -ly, -ment, -ness, -y, and -able in circumstances where suffixation caused no phonological or orthographic changes in the stem when it appeared in the derived form. Children were taught 12 words, six were consistent with the syntactic features of English derivational suffixes, six were inconsistent. For example, -ly served as a verbalizing suffix for one of the rule-inconsistent forms. The children were tested for recall at one week and three week intervals. Across all the grades, the subjects were able to remember the rule consistent forms better than the rule inconsistent forms. Moreover, the children made regularization errors, sometimes producing a rule-consistent form instead of the inconsistent target word. The regularizations accounted for a significant amount of the errors. However, it is important to point out that children did accept and remember rule-inconsistent forms, that their performance showed incomplete mastery on all forms except -er, and that for the very productive, transparent suffix -ness regularizations accounted for only 50% of the errors even for 6th graders.

In a final task, the children were asked to use the nonce stems to produce context appropriate derived forms. At each

grade, children displayed a significant tendency to produce a real word instead of the nonce-derived word, even though the syntactic class of the real word derivative was incorrect for the context. This last finding suggests that the children were insensitive to the syntactic contribution of the suffix.

In general, then, the evidence to date shows three major findings. First, younger readers (high school age or below) can use the morphological structure of a complex word to extract information about the meaning of the root morpheme, at least in certain circumstances (Derwing & Baker, 1979; Condry, 1980; Wysocki & Jenkins, 1985). Subjects are more likely to use morphological structure if the structure is transparent. Second, use of morphological structure varies among individuals; older readers, particularly college readers, tend to use morphology more than younger readers and there is some evidence than better readers also use morphology more when learning new words. Third, often these readers do not appear to use the morphological structure of complex words. Kaye and Sternberg (1982), Freyd and Baron (1982), and Wysocki and Jenkins (1985) found that many subjects did not use a decomposition strategy even to access the semantic core of the root. Freyd and Baron (1982), Wysocki and Jenkins (1985), and Condry (1980) all found evidence of subjects not using the syntactic information provided by suffixes.

However, in many cases, the tasks the subjects were asked to perform might have underestimated subjects' knowledge of

morphology. For example, Derwing and Baker (1977) used a sentence completion task, with sentences such as "A man who teaches is a _____," and counted replies with suffixes (e.g., teacher) as evidence of knowledge of the suffix. Such a task may underestimate the subject's knowledge of morphology on two counts. First of all, there are reasonable but non-suffixed responses for such a task (e.g., creep). Second, it is quite likely that a person's ability to recognize and interpret suffixed forms exceeds that person's ability to produce them.

Tasks used in some of the other studies have similar weaknesses. The definition tasks, particularly the aspects dealing with suffixes, required a great deal of metalinguistic sophistication. The subjects might have actually been able to use morphology during reading to extract meaning from the semantic core of an unknown morphologically complex word or syntactic information from the suffix but this use was not revealed in the tasks they were asked to perform. Finally, all these tasks concentrate on subjects' use of morphology in vocabulary acquisition rather than use of morphological knowledge when reading for comprehesion. The research leaves many questions about the acquisition and use of derivational morphology unanswered.

The present study attempts to address three main questions about English derivational morphology while overcoming some of the methodological problems outlined above:

1. Can high school students use the syntactic information provided by commonly occurring English suffixes in a situation which focuses their attention on suffixes? The subjects were asked to complete a fill-in-the-blank task which tested their ability to appropriately complete a sentence by using suffixed words. This required that subjects use both their knowledge of the syntactic contribution of derivational suffixes and their ability to integrate the syntactic information provided by a particular suffix into the overall syntax of the sentence. While this is not a trivial task, it is far less demanding in terms of metalingusitic sophistication than creating new words or defining abstract morphemes. Moreover, the task focuses the subjects' attention on suffixes which would seem to facilitate the subjects' accessing of their knowledge of derivational suffixes. We assume that this would allow subjects to come closer to using the full extent of their knowledge of derivational morphology.

2. To what extent do derivational suffixes give the reader additional aid, beyond that of non-suffixed forms, in establishing the correct syntactic structure of a sentence when reading for comprehension? A second task attempted to ascertain how these same subjects use their knowledge of derivational morphology under conditions closer to normal reading for meaning. In this task subjects were not alerted to the fact that their knowledge of morphology was being tested.

3. Is there an ability difference in use of syntactic clues associated with derivational suffixes to establish syntactic structure? By testing subjects of a broad ability range, we hoped to determine whether or not knowledge and use of common derivational suffixes varied with reading ability.

Method

Subjects

Participants were 141 10th and 11th grade students from a medium-sized midwestern town. Thirteen were eliminated because they were absent the second day. Five were eliminated because they were non-native speakers of English. Data from 123 subjects, 76 10th graders and 47 11th graders remained for use in the analysis.

Scores from the TAP test (Test of Aptitude and Proficiency), which was administered by the school during the semester in which the study took place, were provided by the teachers for each of the students. Reading scores on the standardized test ranged from grade level 4.3 to 19.9 with a mean of 11.6 and a standard deviation of 3.6. For instructional purposes, the teachers had previously divided students into three groups: low, average, and high. These grouping were based on standardized test scores and classroom performance. The low group was comprised of sophomores and juniors. TAP scores for the low group ranged from 4.3 to 13.7 with a mean of 8.95. The average group consisted solely of juniors. TAP scores for the average classes ranged from 8.3 to

18.9 with a mean of 12.6. The high group was comprised solely of sophomores whose grade level equivalence ranged from 6.7 to 19.9 with a mean of 13.1.

Materials

Three tests were created: a vocabulary checklist test, a comprehension test, and a direct test of morphological knowledge.

Vocabulary test. To assess readers' prior knowledge of the target words, a checklist test was constructed following the guidelines suggested by Anderson and Freebody (1983). A checklist of 400 items was constructed. Each item consisted of a word (or non-word) followed by the words Yes and No. Subjects were instructed to circle Yes if they knew the meaning of the word and No if they did not know the word. The checklist was comprised of items in the following categories:

1. Experimental words, half of which had derivational suffixes and half of which did not, constituted the target words in the Paraphrase task (see below). The checklist included all 192 experimental words, although each subject only encountered 48 of these words in any versoin of the Paraphrase task.

2. Difficult, low frequency English words, e.g., emir, pococurante, sputum.

3. Pseudo-derivatives comprised of actually occurring English stems and suffixes but forming non-occurring complex words, e.g., dogless, earthous.

4. Phonologically possible but non-occurring words, e.g., floot and asfolt. These forms were very similar to real words in English and if the subject claimed to know them, the choice could be construed as a decoding error.

5. Total nonwords. i.e., nonwords which did not fall into categories 4 or 5, werpert.

In order to control for possible position effects three randomized versions of the list were constructed. Each version contained one complete set of words.

Comprehension/paraphrase task. The comprehension task revolved around pairs of words which differed only by derivational suffixes, for example, deceptive/deception. The suffixes used were a subset of the 25 most commonly occurring derivational suffixes, those which change part of speech, in English. More than one derivational suffix might occur on a target word, e.g., tactlessly.

For each pair of words, a sentence frame was constructed in which either word could occur and form a grammatical sentence. For example:

1. a. Mary was afraid that a general indecision about the use of nuclear weapons might be a threat national security.

   b. Mary was afraid that a general indecisive about the use of nuclear weapons might be a threat national security.

Thus, the sentences appear to be exactly the same except for the suffix on the target words. However, for each experimental

sentence the difference in the suffix created a difference in syntactic structure and in the overall meaning of the sentence.

Two additional sentences were created by replacing the target word with a non-suffixed word which matched the suffixed target word for part of speech, frequency, and semantic appropriateness. When it was not possible to find a semantically appropriate word of the same frequency, semantic appropriateness took precedence. For sentences (2a) and (2b), the resulting sentences were:

3. a. Mary was afraid that a general debate about the use of nuclear weapons might be a threat to national security.

   b. Mary was afraid that a general bold about the use of nuclear weapons might be a threat to national security.

These sentences serve as a baseline for the sentences containing the suffixed forms. That is, any difference in subjects' performance between sentences (2a) and (3a) or (2b) and (3b) can be attributed to the fact that the former contain a suffixed word and the latter do not. Any other factors affecting sentence difficulty, whether due to syntax or vocabulary, are the same for these pairs of sentences.

Two paraphrases were constructed for each sentence. One paraphrase matched the meaning of the sentence and one contained a syntactic mismatch. For sentences containing suffixed forms, the correct paraphrase for one member of the minimal pair provided the syntactically mismatched paraphrase for the other

member of the pair. Thus six paraphrases were constructed for each set of four sentences. For example:

a'. Mary feared that if most people couldn't make up their minds about using atomic bombs, the country could be put in danger.

This paraphrase matches sentence a for correct meaning and syntax but contains a syntactic mismatch with the target word (e.g., indecisive) in sentence b.

b'. Mary feared that a military officer who couldn't make up his mind about using atomic bombs might put the country in danger.

This paraphrase matches sentence b for correct meaning and syntax but contains a syntactic mismatch with the target word (e.g., indecision) in sentence a.

c'. Mary feared that a public discussion about using atomic bombs might put the country in danger.

This paraphrase matches sentence c for correct meaning and syntax.

c''. Mary feared that a military officer who openly discussed using atomic bombs might put the country in danger.

This paraphrase contains a syntactic mismatch with the target word (e.g., debate) in sentence c.

d'. Mary feared that a military officer who took a daring position about using atomic bombs might put the country in danger.

This paraphrase matches sentence d for correct meaning and syntax.

d''. Mary feared that if most people took a daring position about using atomic bombs, the country would be put in danger.

This sentence contains a syntactic mismatch with the target word (e.g., bold) in sentence d.

Individual test items were constructed from the four sentence versions and their paraphrases. Each item consisted of a target sentence followed by four paraphrases: one which matched the target word for correct lexical-semantics and syntax, one which matched the target word for lexical-semantics but mismatched it syntactically, one which matched the target word syntactically but mismatched it for lexical-semantics, and one which mismatched the target word for both syntax and lexical semantics.

Example 4 represents a sample item when the target word is suffixed:

4. Mary was afraid that a general indecision about the use of nuclear weapons might be a threat to national security.

   a. Mary feared that if most people couldn't make up their minds about using atomic bombs, the country could be put in danger.
   (Correct)

   b. Mary feared that a military officer who couldn't make up his mind about using atomic bombs might put the country in danger.
   (Syntaxtic Error)

   c. Mary feared that a public discussion about using atomic bombs might put the country in danger.
   (Lexical Error)

   d. Mary feared that a military officer who opnely discussed using atomic bombs might put the country in danger.
   (Double Error)

Paraphrase a matches the target word for both lexical-semantics and syntax. Choosing this answer was interpreted as the subject understanding and using the lexical-semantic and

syntactic information of the target word. Such responses will be referred to as Correct.

Paraphrase b matches the target word for lexical-semantics but mismatches it for syntax. Choosing this answer was interpreted as the subject understanding and using the lexical semantic information of the target word but not the syntactic information. Such responses will be referred to as Syntactic Errors.

Paraphrase c matches the target word for syntax but mismatches it for lexical-semantics. Choosing it was interpreted as the subject understanding and using the syntactic information of the target word but not the lexical-semantic information. Such responses will be referred to as Lexical Errors.

Paraphrase d mismatches the target word for both syntax and lexical semantics. Choosing this answer was interpreted as the subject not knowing or not using any of the information from the target word. Such responses will be referred to as Double Errors.

Example 5 exemplifies a sample item in which the target word is non-suffixed.

5. Mary was afraid that a general bold about the use of nuclear weapons might be a threat to national security.

    a. Mary feared that a military officer who took a daring position about using atomic bombs might put the country in danger.
    (Correct)

b. Mary feared that if most people took a daring position about using atomic bombs, the country would be put in danger.
(Syntactic Error)

c. Mary feared that a military officer who couldn't make up his mind about using atomic bombs might put the country in danger.
(Lexical Error)

d. Mary feared that if most people couldn't make up their minds about using atomic bombs, the country could be put in danger.
(Double Error)

Thus each item contained a target sentence followed by four paraphrases. The paraphrases of the sentences containing the suffixed words always appeared. If the target sentence contained a suffixed word, the two paraphrases of the sentence containing the simple word which matched the suffixed word for part of speech were also included. If the target sentence contained a non-suffixed target word, the sentence was followed by its two paraphrases plus the paraphrases of the suffixed word versions.

For each pair of sentences containing suffixed targets, it was expected that syntax, familiarity of word combinations, world knowledge, and pragmatics might make one version of the sentence seem more natural or easier to understand than the other versions of the sentence. In order to counterbalance for version difficulty, four adults were asked to read the two versions of each sentence in which the suffixed forms appeared. (Two versions of the rating task were used in order to counterbalance for order in which the sentence pairs appeared.) After reading

both versions, the readers were asked to choose which they thought was easier to read. The version which the raters perceived as easier to read was labled Preferred; the version which the raters perceived as being more difficult was labled Non-preferred. Sentence versions in which non-suffixed target words occurred were labled as Preferred or Non-Preferred by analogy with the suffixed versions on the basis of part of speech. For instance, the raters consistently said that "Mary feared a general indecision about the use of nuclear arms . . ." was easier to read than "Mary feared a general indecisive about the use of nuclear arms." Therefore the sentence version containing indecision was labled as Preferred. Because the non-suffixed target word debate matched indecision for part of speech, the sentence version containing debate was also labled Preferred. This rating was used as the basis of the Preference counterbalancing.

Twelve groups of syntactic sentence types were designed with four sentence sets to a group. The sentences within each groups were syntactically parallel. In all, 48 sentence sets were constructed. Four versions of the test were constructed. Versions were counter-balanced for such preference and morphological complexity. Each test contained one sentence from each of the 48 sentence sets. From each of the 12 groups of sentence sets, there was one sentence in each of the following conditions:

(1) The target word was morphologically complex and preferred.

(2) The target word was morphologically complex and not preferred.

(3) The target word was morphologically simple and preferred.

(4) The target word was morphologically simple and not preferred.

Test materials were assembled so the each subject saw only one version of each sentence.

In any test, the first twelve sentences in the test were made up of one sentence from each group. These occurred in a random order. This order was then repeated three times so that sentences from each group were maximally distant from each other in order to avoid syntactic priming. Answer foils were randomized so that each answer type occurred an equal number of times in each position.

Subjects were instructed to choose the paraphrase which came closest to matching the meaning of the target sentence.

Direct test of morphological knowledge: fill-in-the-blank task. The paraphrase task just described provided one test of the use of derivational morphology; however, many factors enter into performance on that task. The task could very well underestimate a subject's knowledge of derivational morphology. To obtain more information on subjects' knowledge of derivational

morphology, a task was devised which focused the subjects' attention directly on suffixes. The logic was that if subjects were alerted to the specific linguistic aspect being tested, they might be able to use a strategy which allowed greater accessing of their knowledge of derivational morphology.

The test consisted of sentences containing a blank which indicated that a word was missing. Below each sentence were four words which could be used to complete the sentence. The four choices were differentiated only by suffixes. For example:

(6) Mary promised to help _____ my computer program.

analytic analytical analyze analysis

Ten sentences followed by actually occurring words of English were constructed. The target words all appear in the Ginn Word Book (1983) which lists words occurring in materials for grade levels K-6. Since the subjects were all 10th or 11th graders, all of them should have been exposed to all the word choices. Part of knowing a word includes knowing its part of speech. Just as speakers acquire knowledge of a non-derived word's part of speech without decomposition, it is logically possible for a speaker to acquire knowledge of a derived word's syntactic features without decomposing it into stem and suffix. One recurring question in the literature on derivational morphology was the extent of reader knowledge of morphological redundancies and readers' abilities to decompose words.

Therefore 12 additional items were developed in which the word choices were made up of pseudo-stems and English suffixes. For example:

(7) I wish Dr. Who would just _____ and get it over with.

transumpation transumptively transumpate transumpatic

In order to access the syntactic information contained in the suffix and consistently choose the correct nonce form, the subjects would have to decompose the nonce word.

The suffixes were a subset of the 20 most commonly occurring English suffixes. Although many of the suffixes of English are syntactically ambiguous, the foils were chosen so that for any given item there was one correct answer or at least one answer which was considerably more probable than the others. In some cases a second grammatically correct, but rather unusual alternative answer proved possible. In these cases, both answers were scored as correct. Answers were randomized so that the correct answer occurred in each position an equal number of times.

Procedures

Testing took place over a two day period. The classroom teachers introduced the researchers and emphasized the importance of the tests. The researchers administered all the tests.

Day one. The three versions of the checklist test were randomly distributed and the directions were read aloud.

Students worked at their own pace. No student took more than 20 minutes to complete the test.

The comprehension tests were arranged beforehand so that each of the eight versions would be equally represented when the tests were distributed. Instructions were read aloud and the group worked through a sample item. Subjects worked the first half (24 items). To ensure that students saw only the first half of the test, the second half was stapled shut. Students were instructed to stop and turn in their booklets when they reached the stapled section. Students worked at their own pace.

Day two. The teachers distributed the comprehension/ paraphrase test booklet and the researchers reviewed the instructions. Students were instructed not to turn back to completed pages. When students finished the comprehension/ paraphrase test, a researcher collected their booklets and gave them the Fill-in the Blank test.

Design and Analysis of Paraphrase Task

A 2 x 2 factorial design was employed: two levels of morphological complexity by two levels of preference. The main independent item variables were morphological complexity of the target word, and preference. Other variables were individual student standardized test score (TAP), prior knowledge of target words as reported on the checklist measure, and the interaction of all these variables. The dependent measure was the proportion

of the subjects' responses that fell into each answer-type category.

Multiple regression analyses were performed separately for each answer type, using hierarchical regression procedures in the manner of mixed between-subject and within-subject analysis of variance. The between-subject factor was ability, represented by scores from the TAP test. Within-subject factors were Suffixation and Preference.

In the phase of the analysis in which total variance was partitioned, the within-subject factors (Suffixation and Preference) were entered first, then the interaction between these factors, the between-subject factor (ability) next, followed by interactions of within-subjects and between-subjects factors.

In the analyses reported here, the data were aggregated by subject; the unit of analysis was the individual subject's performance.

Results

Vocabulary Checklist

The main purpose of the checklist test was to determine the extent to which the target words were known by the subjects. Table 1 gives the percentages of target words checked as known by subjects in the different ability groups, corrected for guessing.

Insert Table 1 about here.

Analyses of variance showed that students in the low ability group knew fewer target words than the other students. Although the ability-related difference in knowledge of the target words appears to be larger for the suffixed words, the interaction representing this difference (Suffixation x Ability Group) does not approach significance.

Fill-in-the-blank. The "fill-in-the-blank" test reflects students' ability to make use of the syntactic information in derivational suffixes when their attention is drawn to these suffixes. Table 2 gives the percentage of correct responses for each ability group, for real words and nonce words. (These percentages are not corrected for guessing.) For real words, a subject could answer correctly based on knowledge of the word as an (unanalysed) unit; for the nonce words, knowledge of the syntactic properties of the suffix is necessary for a correct answer. Pearson r correlations were calculated for subjects' scores on real and nonce words and their Standardized Test score. Results showed a mildly strong correlation of .4 with real words and .5 with nonce words, in spite of a strong ceiling effect on the fill-in-the-blank task. Better readers scored higher on the task than poor readers. All three groups scored higher on real

words than on nonce words. Performance on Real words correlated .57 with performance on Nonce words.

Insert Table 2 about here.

Paraphrase. The means of each ability group for each answer type are given in Table 3.

Insert Table 3 about here.

As can be seen from Table 3, the Average and High groups had similar results. For all groups, Syntactic Errors are the most frequent error, and Double Errors the least frequent.

Effects of Suffixation and Preference. Of prime interest us is how the experimental sentence conditions--Suffixed vs. Non-suffixed target words and Preferred vs. Non-preferred sentence patterns--affected the different answer types, and whether these effects were conditioned by ability level.

Tables 4-7 summarize the multiple regression analyses for each answer type. The dependent variable was the proportion of responses falling into each answer type category. The tables represent final, reduced models from which nonsignificant variables and interactions have been deleted. The figures in the column captioned Between are based on the analysis that included only the between-subject variable Ability. The figures in the

column headed Total are based on the analysis that included all of the variables. The column labeled % Variance gives estimates of the magnitude of the effect of each variable derived from the increment in $\underline{R}^2$ at the point where the variable entered the analysis. In the rows labeled Constant/Residual, the first number is the constant (the intercept) and the second number is the residual, i.e., the unexplained, or error, variance.

Insert Tables 4-7 about here.

For Correct responses, the chief finding is a strong main effect of Preference. Students were more likely to respond correctly when the target word was preferred, that is, was more consistent with the syntactic, semantic and pragmatic expectations given by the surrounding context.

The interactions of Suffixation x Preference and Ability x Suffixation x Preference were also significant. As Figure 1 indicates, these interactions reflect the fact that for the lowest ability group, the effect of preference is stronger for Suffixed than for Non-Suffixed target words.

In Figures 1-4, the vertical axis represents the percentage of responses in that answer type category that fell into each of the four sentence conditions (Suffixed-Preferred, Suffixed-Non-Preferred, Non-Suffixed-Prefered, and Non-Suffixed-Non-Preferred). Thus, these figures do not show differences in the

absolute number of responses falling into an answer type category, but how the total number of responses in that category was proportioned among the four sentence conditions. It should also be noted that in these figures, subjects are divided into ability groups based on classes in school, whereas in the multiple regression analyses, Ability was represented as a continuous varible.

Insert Figure 1 about here.

For Syntactic Errors, there are main effects of both Preference and Suffixation, and also an Ability x Suffixation interaction. Syntactic Errors are more common for target words in the Non-preferred condition (see Figure 2). There are also more Syntactic Errors for Suffixed than for Non-Suffixed target words. The Ability x Suffixation interaction indicates that the effects of Suffixation are slightly more pronounced for lower ability students.

Insert Figure 2 about here.

For Lexical Errors the only significant effect is that of Suffixation: There are fewer Lexical Errors for Suffixed target words than for Non-Suffixed target words (see Figure 3).

Insert Figure 3 about here.

For Double Errors there are main effects of Suffixation and Preference. There are more Double Errors for target words in the Non-Prefered condition, and more Double Errors for Non-Suffixed than Suffixed target words (see Figure 4).

Insert Figure 4 about here.

Discussion

Ability and Knowledge/use of Derivational Morphology

Our basic question concerned the relationship between reading ability and the knowledge and use of the syntactic information provided by derivational suffixes. The results provide several types of evidence that better readers were better at using the syntactic information in suffixes.

First, there is the correlation between performance on the Fill-in-the-Blank test and a standardized ability measure (TAP). The correlations (.4 for real words and .5 for nonce words) are fairly high, considering the strong ceiling effect on the Fill-in-the-Blank task. We believe that the Fill-in-the-Blank test maximizes the subject's opportunity to utilize whatever knowledge about derivational suffixes he or she possesses. The simplicity

of the task leaves little room for test-taking skills to have an effect.

The results of the Paraphrase task give additional evidence about the relationship of ability and use of suffixes in determining sentence structure. The clearest evidence is the significant Ability x Suffixation interaction for Syntactic Errors. The data on Syntactic Errors show that Suffixed target words pose greater problems to high school readers than do Non-Suffixed target words. The Ability x Suffixation interaction indicates that this effect is most pronounced for low-ability readers.

In the case of Double Errors, Suffixation provides some advantage; there are fewer Double Errors for Suffixed than Non-Suffixed forms. The positive B-weight of the Ability x Suffixation interaction indicates that this advantage of suffixation is less for low-ability readers, and greater for high ability readers.

In the case of Correct Responses, there is an Ability x Suffixation x Preference interaction. As is apparent from Figure 1, this indicates that Preference has a greater effect for Suffixed than Non-Suffixed forms, but this holds only for low-ability students.

The Paraphrase task, then, shows that suffixed words pose more of a problem for low-ability high school readers than for their high-ability counterparts.

Suffixation and Syntactic Errors

We originally noted that derivational suffixes potentially provide readers additional aid, beyond that provided by non-suffixed forms, in determining the syntactic structure of a sentence when reading for comprehension. We had hypothesized that better readers, at least, would do better on Suffixed target words than Non-Suffixed target words. If the syntactic information inherent in derivational suffixes were utilized during reading, students should have made more Correct responses, and fewer Syntactic Errors, for Suffixed target words than for Non-Suffixed target words.

Our results offer no support for this hypothesis. For the answer type Correct Responses, there is no main effect of suffixation, i.e., no overall difference between the number of Suffixed and Non-Suffixed target words responded to correctly. For the answer type Syntactic Errors, the results are the opposite of what was predicted: there are more Syntactic Errors for Suffixed target words than for Non-Suffixed target words. (There were, in fact, fewer Lexical Errors for Suffixed target words than Non-Suffixed target words, but the hypothesis in question made no prediction about Lexical Errors.)

It appears, then, that rather than providing extra information about the syntactic category of a word, derivational suffixes pose some sort of additional difficulties for readers, at least as far as determining the syntactic structures of

sentences is concerned. Or perhaps it should be said that the additional help the suffixes offer is either not utilized, or else outweighed by other difficulties that the Suffixed words introduced.

There are two possible explanations for why suffixed forms induced more syntactic errors than non-suffixed forms: either the subjects were unfamiliar with the syntactic properties of the derivational suffixes or some basic difference exists between morphologically complex and simple words which makes complex words more likely to induce syntactic errors.

The results of the fill-in-the-blank task clearly eliminate the first hypothesis. Although good readers performed better than poor readers, most of the high school students performed well above chance on this task. It can be concluded that almost all these high school students possess fairly accurate knowledge of the syntactic properties of common English suffixes, and are able to make correct judgments about the syntactic category of novel words on the basis of the suffixes alone. If the subjects made more syntactic errors because of a basic difference between complex and simple words, what is the nature of that difference? One possibility is that morphologically complex forms are more difficult to process because the reader must perform extra operations in order to access them. For instance, if complex forms are stored as separate morphemes rather than as independent words, presumably some computational task would have to be

performed in order to access the entire word. However, experimental evidence indicates that accessing complex forms in isolation does not cause an increase in on-line processing demands.

Kintsch (1974) conducted a series of experiments aimed at determining whether differences in processing difficulty existed between simple and derived nouns and verbs. In two experiments 20 undergraduates were shown a word and asked to generate a sentence using it. The target words were matched for frequency, abstractness, and imagability. The latency between the appearance of the target word and the beginning of the subject's response was recorded. There was no reliable difference in response times between complex and simple forms.

Manelis and Tharp (1977) used a lexical decision task to compare processing difficulties of complex and simple forms. Words were selected which could either correctly or incorrectly be analyzed as base + suffix. For example, printer could be thus analyzed, slander could not. Pairs of the words were presented visually and the subjects were asked to affirm as quickly as possible if the forms were real words of English. Response time to truly suffixed words did not differ reliably from response time to non-suffixed words. Moreover, in a recent review of the literature on lexical complexity, Cutler (1983) concluded that "there is no indication that suffixed forms are more difficult to process than matched simple forms." These studies deny that

there is an increased computational cost involved in accessing complex forms. The difference in morphemic composition of the word, i.e., in the number of identifiable morphemes within a simple word (one morpheme) and a complex word (two or more morphemes), does not appear to be the source of increased syntactic errors for complex target words.

As well as differing in number of morphemes which comprise a single word, complex and simple words also differ in the number of other words they are related to in the language. Complex forms are members of recognizable word families while simple forms are not. We suggest that this difference in family relationships may be the source of the increase in syntactic errors for complex target words. This possibility arises from the fact that membership in a word family means that a number of morphologically related words which are visually, semantically, and phonologically similar are simultaneously competing for activation as the word is being processed.

Using a repetition priming task, Stanners, Neiser, Hernon, and Hall (1979) found that morphologically related words prime each other to varying degrees. Regularly inflected verb forms (-ed, -s, -ing) primed the base verb as well as the base verb primed itself. Irregular inflections (which vary from regular inflections in terms of visual and phonological similarity) caused some priming but not as much as the base verb primed itself. Finally, adjectival and nominative derivatives primed

the base verb but not to the extent that the verb itself or the irregular inflection primed the base. Stanners et al. did not systematically test for differences among derivational suffixes. Generally, however, their results appear to support the hypothesis that the more visually, phonologically, and semantically similar two morphologically related forms are, the more likely misactivation might take place. To test this prediction, a post hoc analysis of complex target words was performed. Complex words ending in suffixes such as -er, and -ness which did not cause the base morpheme to change pronunciation or spelling were compared to words ending in suffixes such as -ity and -(a)tion which did cause changes in pronunciation and spelling. The analysis showed that subjects made significantly more ($p < .01$) syntactic errors on transparent forms, i.e. those which did not cause pronunciation or spelling changes thus offering support for the misactivation hypothesis. This result is particularly impressive because suffixes such as -er and -ness are the most frequently occurring and first acquired (Clark & Berman, 1984) and therefore probably the best known by our subjects. If the source of increased errors was because of some increased difficulty with the suffix itself, we might expect that these transparent suffixes would be the least likely to cause errors.

Suffixed forms had more Syntactic Errors, but fewer Lexical Errors, than Non-Suffixed forms. One way to account for this

would be to hypothesize that when a suffixed form (e.g., deception) is encountered, another word with the same stem (e.g., deceptive) may be accidentally accessed. Such a mistake would result in a Syntactic Error rather than a Lexical Error.

Our results do not give enough evidence to determine just how misactivation would occur. It could happen if the word were accessed via the stem and the information from the suffix somehow lost. Alternatively, the encounter with a morphologically complex word while reading may prime its morphological relatives, so that under certain circumstances, the wrong word might reach the threshold of activation and be accessed. We cannot tell, either, to what extent our results reflect processes unique to the paraphrase task. Some proportion of the errors may occur while the reader goes back to check the target sentence against the possible alternatives. In any case, the results of the paraphrase task show that suffixed words behave differently than non-suffixed target words similar in frequency; the convergence of evidence indicates that the difference is not that suffixed forms are more difficult to process in isolation but that the organization of the internal lexicon and accessing processes allow for misactivation of suffixed forms.

Preference and Parsing Strategies

The effect of Preference on students' performance on the Paraphrase task was not unexpected, but was surprisingly strong. Interestingly, there was no Suffix x Preference interaction which

shows that Preference effected both suffixed and non-suffixed forms. This effect gives us important information about how readers determine the syntactic structure of sentences.

We had expected at least good readers to use the syntactic information provided by the target word to help them figure out the syntactic structure of the sentence in which the target word occurred. However, the high level of syntactic errors shows that often the syntactic information of the target word was not used. The effect of Preference suggests that when readers encountered a target word, they already had strong syntactic expectations. These 'top down' expectations frequently overruled the 'bottom up' syntactic information provided by the word itself, leading to a higher rate of Syntactic Errors in the Non-Preferred condition. (We believe that these expectations are primarily syntactic, since Preference had a very strong effect on Syntactic Errors, but no effect on Lexical Errors. That is, when a word did not match the expectations set by the surrounding context, readers were more likely to make mistakes about its syntactic category, but there was no such effect concerning its lexical semantics.)

Linguists such as Fodor, Bever and Garrett (1974), Frazier and Fodor (1978), and Frazier and Rayner (1982) have found evidence that English speakers develop parsing strategies which lead them to read with certain syntactic expectations. These expectations sometimes lead readers to make parsing errors and they parse a syntactically unexpected configuraton as if it were

the syntactically expected one. For instance, Frazier and Fodor have argued that English speakers use a Minimal Attachment strategy in which incoming material is attached into the phrase marker being constructed using the fewest nodes possible and still being consistent with well-formedness conditions. So, Frazier and Fodor note that the sentence, "The linguist knew the solution to the problem," is easier to parse than, "The linguist knew the solution to the problem would be difficult." Their explanation is that the parser will initially interpret the phrase the solution as a simple NP direct object in both sentences. In the second sentence this analysis will have to be re-interpreted when the phrase would be difficult is encountered. The need to re-interpret is caused by the parser anticipating one type of structure and actually encountering an unanticipated structure.

In order to correctly interpret syntactically non-preferred sentences, readers must also pay attention to surface cues which tell them when a parsing strategy is inapplicable. Sometimes the reader may miss the cue or fail to interpret it correctly, ending by misinterpreting the syntactic structure of the sentence. In these cases, the parsing strategy can be seen as leading the reader astray. The parsing strategy literature refers to sentences which consistently lead the reader astray as Garden Path sentences.

Essentially, Garden Path sentences are difficult to process because they contain a syntactic structure which is ambiguous and whose correct syntactic interpretation is the less preferred of the two choices. Recall that the sentences in our study exploited structurally ambiguous syntax:

a. Mary was afraid that a general indecision about the use of nuclear weapons might be a threat to national security.

b. Mary was afraid that a general indecisive about the use of nuclear weapsons might be a threat to national security.

In these sentences in addition to structural ambiguity there is also lexical ambiguity, general is ambiguous as it can either be interpreted as an adjective or a noun. The interpretation of general as an adjective creates particular syntactic expectations. If the reader interprets general as an adjective, he will anticipate that the next element is likely to be a noun. If he interprets general as a noun, he will anticipate that the next element is likely to be a verb or an adjective. Furthermore, if one of the interpretations is syntactically preferred in that situation, the syntactic expectation could interfere with the reader establishing the correct syntactic expectation in the non-preferred sentence. In fact, this appears to be the case in this example.

The phrase structure trees of the two sample sentences reveal that sentence a contains fewer nodes than sentence b; thus

according to the Minimal Attachment Principle, a should be easier to parse than b.

Insert Figure 5 about here.

This prediction matches the intuitions of our adult raters as well as the performance of the subjects.

The pattern of errors evident in our results suggested that the subjects might have been 'garden pathed' in a number of instances. We analyzed the syntactic structures of the target sentences and then matched these structures against the Late Closure and Minimal Attachment strategies investigated by Frazier and Fodor (1978). The parsing strategies made clear predictions for syntactic preference in 88% of the experimental sentences. Subject responses on syntactic errors were then compared to predictions made by the parsing strategies. The sentences which the parsing principles determined to be more difficult and the actual proportion of syntactic errors made by the subjects correlated stongly ($r = .6$, $p < .001$).

The accuracy of the parsing strategy predictions led us to conclude that much of the Preference effect was due to sentence level syntax and the syntactic expectations with which the subjects were reading. However, parsing strategies alone are not enough to explain the very high level of syntactic errors. If the subjects used all the information from a target word, then

its syntactic category information should act as a signal that the syntactic structure being processed was not the anticipated one. Once the reader received such a signal, we assume that the parsing strategy would be suspended and the syntactic structure re-interpreted. The pattern of errors indicates that the syntactic information associated with the target words, both suffixed and non-suffixed, failed in a significant number of cases to signal the reader that the parsing strategy should be suspended. In other words, although the readers appear to have used the semantic information from the target words, they failed to use the syntactic information.

One explanation of this result is that readers use information from lexical entries selectively. We conceive of selective use as the consequence of a strategy used by readers which allows them to cut down on the amount of detailed information being processed on-line. It is analogous to load reducing strategies which humans appear to use in many circumstances. For instance, as we walk down a street, we perceive a myriad of detailed visual, olfactory, auditory, and tactile information. We do not attend to all the information--to do so would put a great burden on our processing mechanisms and we do not need to in order to get to our destination. We appear to selectively ignore information which we deem irrelevant or predictable.

A similar strategy of selective attention could very well be used in accessing detailed information from lexical entries during sentence processing. We assume that the reader would selectively ignore information only if he assumed that it was irrelevant or predictable.

We hypothesize that in discourse the part-of-speech information of a lexical item in English is often predictable from the surrounding context and is, therefore, a likely candidate for being selectively ignored. One type of evidence of the predictability of syntactic category is the freedom with which words can be transferred to new syntactic categories with zero affixation, that is, with no overt marking of the change in syntactic category. In young children, this process is a productive means of expanding vocabulary (Clark, 1978); children often produce sentences such as "I broomed the floor" in which a noun is turned into a verb. Adult coinages show a similar pattern, "They partied all night."

This type of part-of-speech change is not limited to the transformation of nouns into verbs. Verbs can be turned into nouns, "We got an invite to the party." Adjectives can be used as nouns, "News about the young usually interests teachers."

Such part of speech changes occur even with words whose syntactic category is overtly marked by derivational suffix, for instance the verbs to position and to requisition. Such examples may be less frequent, but coinages violating the syntactic

identity of derivational suffixes do occur; for example, a high school teacher was heard saying that a student had proficiencied out of the Reading Lab.

These part-of-speech changes, even if some are recognizably novel, leave the listener in no doubt about the syntactic structure of the sentence. This is because in English, the syntactic role of a lexical item (if it is a content word) is almost always predictable from word order and function words.

Many of the most commonly occurring words of English have undergone zero affixation. As a result many commonly used words are syntactically ambiguous. For example, to water, the water; to man, the man; to look, a look. This means that for such words, lexical information about syntactic category cannot disambiguate a sentence syntactically. The only way to find out whether an instance of the word water is a noun or a verb is to look at the surrounding context. For many of the most frequently used words of the langauge, looking to a lexical entry for syntactic category information is not only redundant but also useless. Thus it seems plausible that readers could develop a strategy of not always attending to the syntactic category information of individual lexical items.

Lewis Carroll's Jabberwocky shows that it is possible to determine the syntactic structure of a text on the basis of word order and function words, without knowing the syntactic categories of the content words. Our results indicate that such

syntactic expectations not only make syntactic features of content words redundant, but sometimes even override part-of-speech categories overtly marked by derivational suffixes.

Conclusions: The role of Derivational Morphology in Reading

Our results confirm Shaughnessy's (1977) point that, when combined with difficult syntax, derivational suffixes are a problem rather than a help, especially to lower ability students. The present study shows that this holds for reading as well as writing.

It would be premature to draw any detailed instructional implications from these findings. As a step in the direction of drawing instructional implications, however, it is important to determine how derivational suffixes are used in reading. Possible functions of derivational morphology in reading fall under three headings: Syntactic Parsing, Vocabulary Acquisition and Lexical Access.

As already discussed, we had hypothesized that readers might utilize the syntactic clues provided by derivational suffixes to aid in parsing syntactically complex sentences. Our results, however, suggest that even good high school readers do not use derivational suffixes in this way. At all ability levels, there were more Syntactic Errors for Suffixed forms than for Non-Suffixed forms; none of the students seemed to find derivational suffixes any help in parsing difficult sentences.

Another possible use of derivational suffixes is in dealing with new words. Although most studies have failed to find convincing evidence that most pre-college readers use morphological knowledge when learning new words, methodological problems may have masked readers' use of suffixes. The results of our Fill-in-the-Blank test show clearly that most high school students are in fact able to make accurate predictions about the syntactic properties of new words on the basis of their suffixes. Ability to do this appears to be strongly correlated with general verbal ability, confirming the results of Freyd and Baron (1982).

Finally, knowledge of the internal structure of words may be used in the process of lexical access. The experimental literature does not give an unequivocal answer to the question of whether readers routinely analyze morphologically complex words in the process of accessing lexical items, but it is likely th the ability to do so may facilitate lexical access under some conditions. Bradley (1979) found that family frequency was a better predictor of reaction time than individual word frequency for forms ending in -ness, -er, -ment. Kempley and Morton (1982) also found a decrease in reaction time for words which were members of high frequency families. The students in our study made fewer Lexical Errors on Suffixed words than Non-Suffixed words. This finding does not allow us to draw detailed conclusions about a model of lexical access, but it certainly

gives support for a model in which recognizing the internal morphological structure of a word aids in accessing its meaning.

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Table 1

Percentage of Target Words Checked as Known on Vocabulary Test

Ability Group	Percent Known[a]	
	Suffixed	Non-Suffixed
Low	72.6 (24.8)	78.1 (23.4)
Average	89.5 (18.0)	90.1 (17.7)
High	89.4 (11.3)	89.9 (11.2)
All Subjects	83.0 (20.6)	85.5 (19.0)

[a]Standard deviations in parentheses

Table 2

Percentage of Corrent Answers In "Fill-in-the-Blank" Test of Knowledge of Suffixes

	Percent Correct[a]	
Ability Group	Real Words	Nonce words
Low	84.4 (21.3)	67.8 (20.2)
Average	97.2 (7.0)	83.1 (11.5)
High	92.9 (10.3)	88.0 (14.1)
All Subjects	90.7 (15.7)	79.3 (18.4)

[a]Standard deviations in parentheses

Table 3

Percent of Responses in Each Answer Type

Ability Group	Answer Type[a]			
	Correct	Syntactic Errors	Lexical Errors	Double Errors
Low	42.2 (17.5)	20.3 (12.9)	18.6 (11.1)	14.6 (11.7)
Average	62.2 (19.6)	17.9 (13.3)	11.6 (9.5)	8.1 (10.0)
High	61.9 (21.2)	15.4 (13.2)	12.5 (10.8)	8.0 (9.8)
All Subjects	54.6 (21.7)	17.8 (13.3)	14.5 (11.1)	10.5 (11.0)

[a]Standard deviations in parentheses

Table 4

Multiple Regression Analysis of Paraphase Test Correct Response

Variable	Regression Coefficients Between	Total	Percent of Variance	F
Between Subjects				
Ability	3.4	0.0	50.4	119.9
Constant/Residual	15.4		49.6	
Within Subject				
Preference[a]		5.2	33.9	250.5
Suffixation[b]		-1.6	0.1	0.7
Suffixation x Preference		4.5	0.7	5.0
Ability x Suffixation		0.1	0.1	0.5
Ability x Preference		0.2	0.4	2.8
Ability x Suffixation x Preference		-0.3	0.6	4.3
Constant/Residual		-0.0	64.3	

Note. Critical value(1,475) = 3.86, $p < .05$; 6.70, $p < .01$

[a]Coded +1 Preferred; -1 Non-Preferred

[b]Coded +1 Suffixed; -1 Non-Suffixed

Table 5

Multiple Regression Analysis of Paraphase Test Syntactic Errors

Variable	Regression Coefficients Between	Total	Percent of Variance	F
Between Subjects				
Ability	-0.9	-0.0	22.9	35.0
Constant/Residual	28.1		77.1	
Within Subject				
Preference[a]		-5.4	22.7	158.3
Suffixation[b]		6.3	7.8	54.6
Suffixation x Preference		-0.9	0.7	4.8
Ability x Suffixation		-0.2	0.7	4.9
Constant/Residual		-0.0	68.1	

Note. Critical value(1,475) = 3.86. $p < .05$; 6.70, $p < .01$

[a]Coded +1 Preferred; -1 Non-Preferred

[b]Coded +1 Suffixed; -1 Non-Suffixed

Table 6

Multiple Regression Analysis of Paraphase Test Lexical Errors

Variable	Regression Coefficients Between	Total	Percent of Variance	F
Between Subjects				
Ability	-1.1	---	33.5	59.5
Constant/Residual	27.5		66.5	
Within Subject				
Suffixation[a]		-1.2	2.1	10.0
Constant/Residual		-1.2	97.9	

Note. Critical value(1,475) = 3.86, $p < .05$; 6.70, $p < .01$

[a]Coded +1 Suffixed; -1 Non-Suffixed

Table 7

Multiple Regression Analysis of Paraphase Test Double Errors

Variable	Regression Coefficients Between	Total	Percent of Variance	F
Between Subjects				
Ability	-1.1	-0.0	27.1	43.9
Constant/Residual	23.7		72.9	
Within Subject				
Preference[a]		-2.6	10.9	60.7
Suffixation[b]		-3.8	3.0	16.8
Ability x Suffixation		0.2	0.9	5.0
Constant/Residual		-0.0	85.2	

Note. Critical value(1,475) = 3.86, $p < .05$; 6.70, $p < .01$

[a]Coded +1 Perferred; -1 Non-Preferred

[b]Coded +1 Suffixed; -1 Non-Suffixed

Figure 1

CORRECT RESPONSES - DISTRIBUTION BY SUFFIXATION AND PREFERENCE

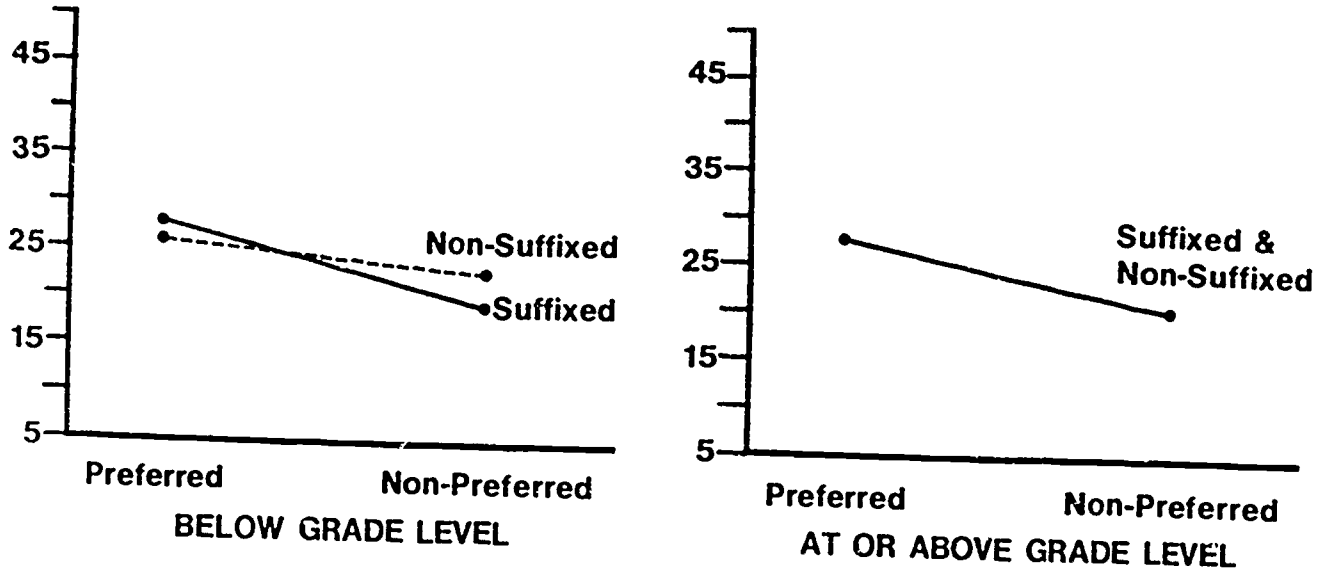


Figure 2

SYNTACTIC ERRORS - DISTRIBUTION BY SUFFIXATION AND PREFERENCE

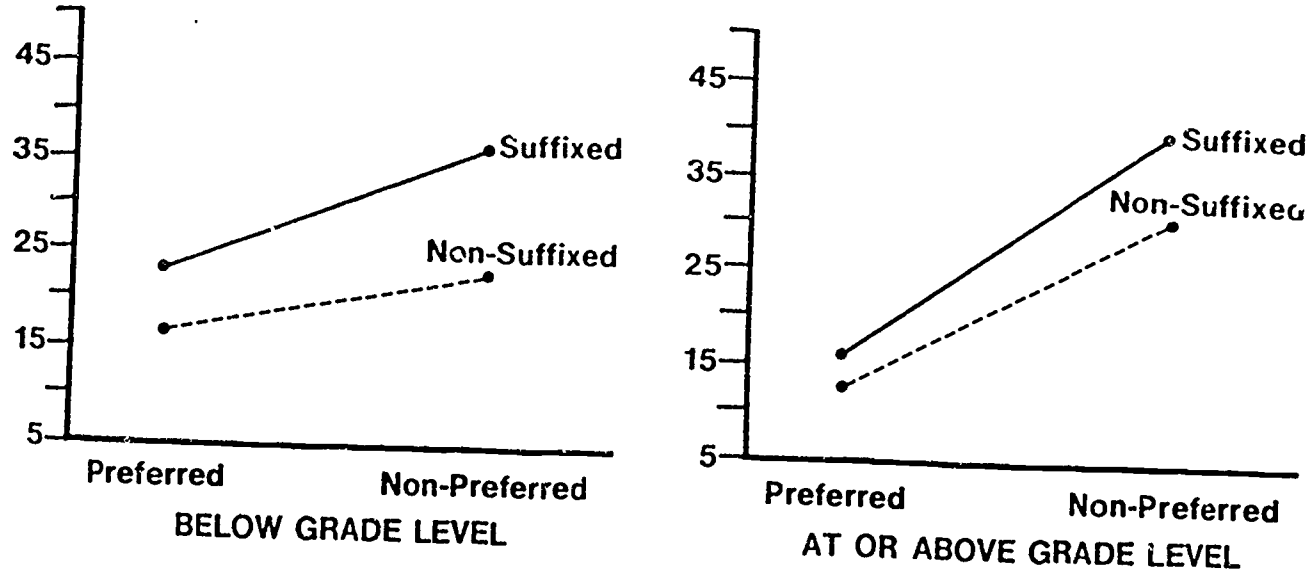


Figure 3

LEXICAL ERRORS - DISTRIBUTION BY SUFFIXATION AND PREFERENCE

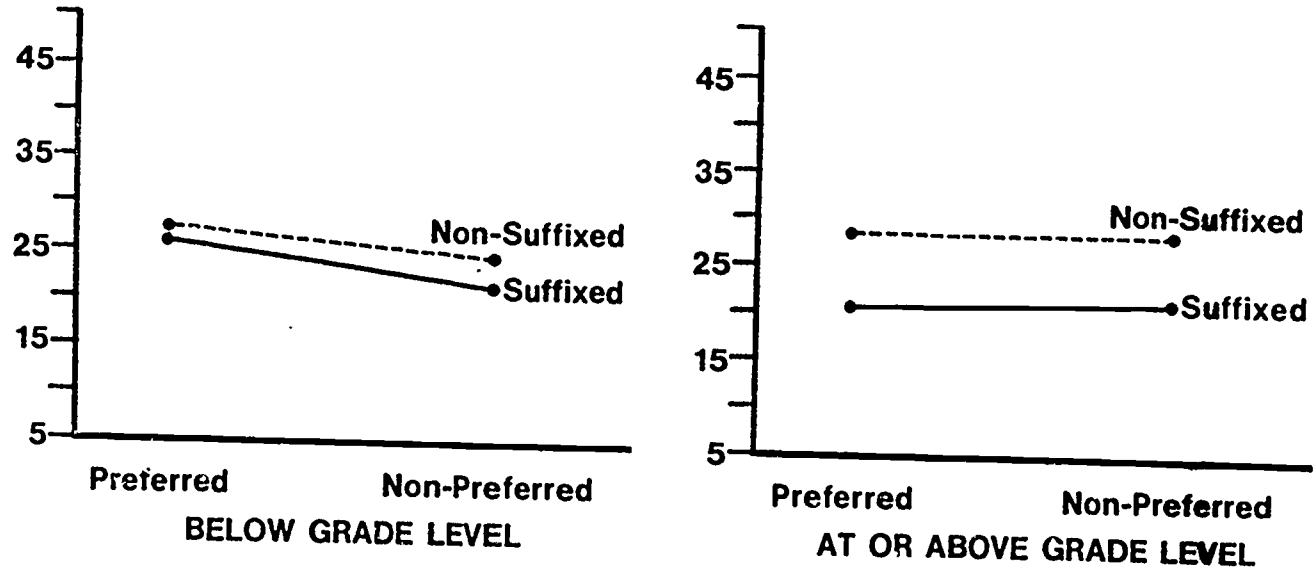


Figure 4

DOUBLE ERRORS - DISTRIBUTION BY SUFFIXATION AND PREFERENCE

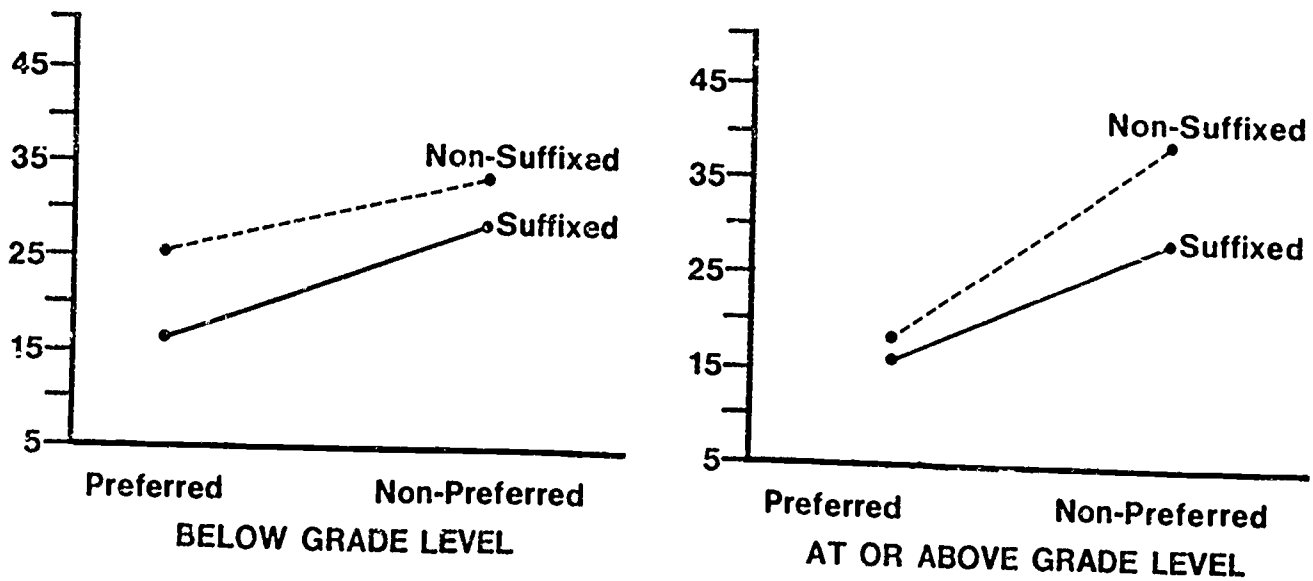
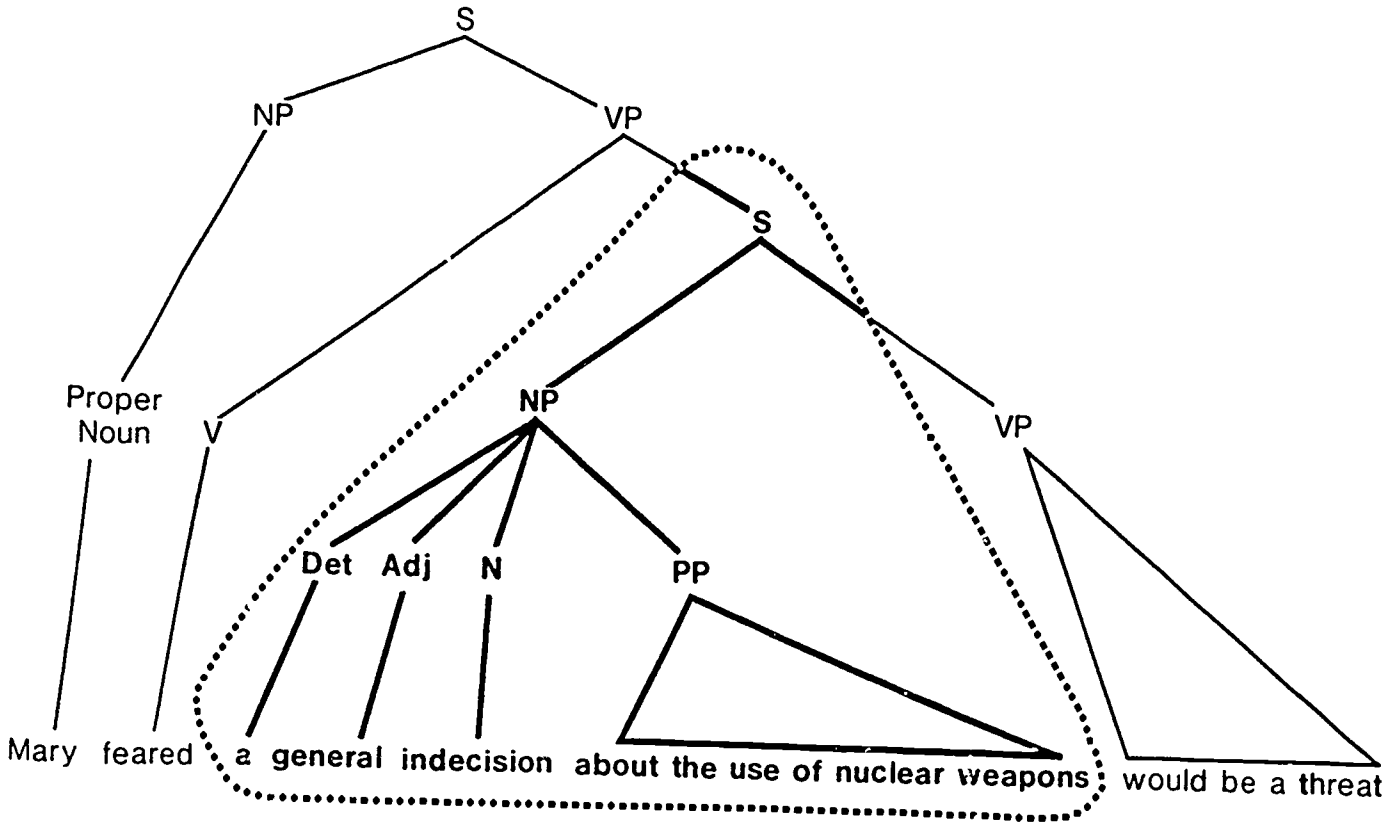
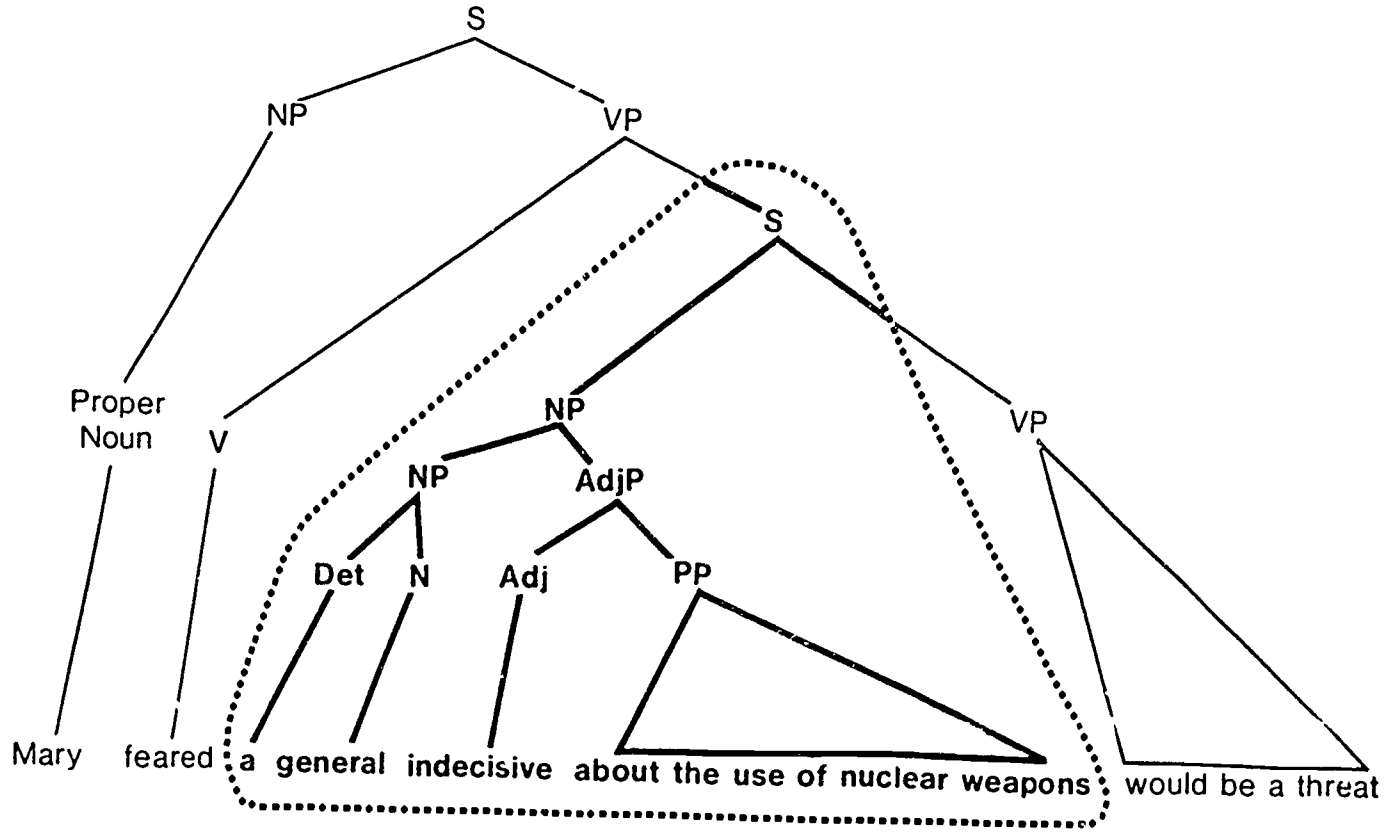


Figure 5


S
NP
VP
Proper Noun
V
S
NP
VP
Det
Adj
N
PP
Mary
feared
a general indecision about the use of nuclear weapons
would be a threat


S
NP
VP
Proper Noun
V
S
NP
VP
NP
AdjP
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a general indecisive about the use of nuclear weapons
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